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THE JOURNAL OF PHILOSOPHY

PSYCHOLOGY AND SCIENTIFIC METHODS

THE REEDUCATION OF AN APHASIC

THE possibility of the speech reeducation of aphasics has long been known and we have several accounts of cases in which after periods of several years patients have practically recovered their normal ability of speech.¹ The method of this reeducation, however, is not known. It is uncertain whether new brain paths are opened in the reacquirement of language and a new habit formed or old paths utilized. There is usually a 'normal' amount of recovery in nearly every case of aphasia, so that a person is able after some days or weeks to speak (if a motor aphasic) or to understand (if the aphasia is of a sensory type) some words or phrases. The suggestion has been made that this so-called recovery is merely the normal functioning of the right side of the cerebrum.

For several months I had the opportunity of observing an aphasic man and of attempting to train him to speak. The patient was a mechanic, aged fifty-seven, who had had a paralytic stroke four weeks before entrance to the hospital on December 12, 1904. His right side had been paralyzed and he was unable to speak. In three weeks after the seizure the paralysis had disappeared but there remained almost complete inability to make himself understood. At first all questions were answered unintelligibly or by 'yes' or 'no.' Later he improved greatly so that sometimes he could answer simple questions regarding himself fairly well, although often his answers were irrelevant and his talk unintelligible.² He had no disorder of hearing or of vision. He was often unable to understand spoken or written language, particularly when long sentences were used, and was unable to talk clearly, using many words and naming objects wrongly (*i. e.*, paraphasia). The difficulty in understanding written and printed speech was so marked at first as to

¹ For a recent account of some cases and discussion see C. K. Mills, 'Treatment of Aphasia by Training,' *Journ. Amer. Med. Assoc.*, 1904, XLIII., 1,904-1,949.

² It should be noted that the patient was not insane, although he was brought for treatment to a hospital for the insane.

suggest some disturbance in the visual sphere, but there was no hemianopsia, and nothing else to indicate such a disorder. During later examinations the patient was found able to read correctly practically everything, provided he was compelled to pay attention to the individual words, or to the syllables of the longer words. His ability to repeat words, syllables and phrases was very poor. There was evidently a great sensory speech defect, with possibly some motor speech disturbance.³

The experiments which were made towards training the patient were comparatively simple, and were chosen not so much to reeducate the man for his daily work as to see how the process of reeducation took place.⁴ Attempts were made to get the patient to relearn (*a*) the names of ten familiar colors, of the nine numerical digits and the number ten, (*b*) a short stanza of poetry and (*c*) the Lord's Prayer. Towards the end of the series of experiments I had the patient try to acquire the German equivalents of a few common English words.

*Color and Number Education.*⁵—A careful examination of the patient soon after his arrival at the hospital showed rather poor ability to name both colors and numbers. There was a tendency to use wrongly the names of colors when describing an object, and often to use the names of colors as names of objects. For example, a piece of glass was called 'green paper.'

In the reeducation of color names ten colored cards, each three inches square, were shown one at a time to the patient. He was asked to name the color of the card placed before him. If this was done correctly he was told 'correct,' if incorrectly, he was told that what he had said was 'wrong' and then he was given a second and sometimes a third opportunity. If after three or four attempts he did not give the right name, he was told the name, and then attempted to repeat it. Sometimes he realized after one trial that he did not know and said so, thereupon the name was given to him and he repeated it (not always successfully, however). The following are the colors which were used: white, gray, black, red,

³The patient died May 1 of pulmonary infarcts. There was an old embolus of the left middle cerebral artery which had caused the primary paralysis and the aphasic condition. Examination of the brain showed a softening of the cortex, chiefly of the left first temporal and the angular gyri. A full report of the case may appear later.

⁴At the patient's age it would have been almost impossible to have sufficiently trained him even had he lived for some years. In the cases of reeducation which have come to my notice, all the patients were in the early years of middle life, when new associations are more easily formed than after the age of fifty.

⁵For many of the results in this section I am indebted to Dr. W. F. Roberts, who carried on this part of the work under my direction.

yellow, green, blue, purple, brown and pink. In the daily experiments these cards were thoroughly shuffled so that no special order was used, and the names of the colors could not be associated with the sequence.

The accompanying tables give percentages of correct answers, the number of experiments, the number of mistakes in naming each color and the frequency of the wrong use of names.

TABLE I.

Percentages of correctly named colors.

Date.	Percentage Correct.	Number of Experiments.
Dec. 21-24	43.6	39
Jan. 12-14	45.0	40
Jan. 16-21	72.5	109
Jan. 24-28	84.7	118
Jan. 31-Feb. 4	87.7	114
Feb. 6-10	93.5	107
Feb. 15-18	92.6	108
Feb. 21-23	95.2	63
March 15	95.2	105
March 17	96.1	52

TABLE II.

Incorrect naming of colors.

Colors.	Incorrectly Named.	Name Used Incorrectly.
White.	6	0
Gray.	14	24
Black.	4	1
Red.	12	8
Yellow.	14	6
Green.	4	8
Blue.	8	29
Purple.	6	6
Brown.	18	10
Pink.	18	2
Orange.	—	4
Numerals.	—	5
Miscellaneous (including non-sense words).	—	22

In Table I. the number of experiments, it will be noticed, differed considerably from week to week. An attempt was made to show each color once each day in the earlier part of the work, but when the patient wrongly named a color and was given a second opportunity this has been counted an extra experiment. The gradual increase in ability is marked, and in the three weeks' interval between February 23 and March 15 there had been no loss of the association of the correct word with the colored piece of cardboard. There was a gradual betterment in naming from week to week, with a tendency to approach the 100 per cent. mark. On the last day of this series when fifty colors were shown, in only two cases did the patient make mistakes in naming, and these he instantly corrected.

During the first few weeks the colors most difficult to name were purple, brown and pink. For purple the patient had at first considerable difficulty, not only in naming the color, but also in repeating the name when it was given to him, but once he had acquired the name the color was always thereafter properly named. The other colors showed nothing striking beyond the tendency to mix the words brown and gray. Blue was evidently one of his stock words and was employed under most conditions when there was any doubt or hesitancy.

It was surprising, however, that 'green' and 'brown' were not more often wrongly used. These words were stock words in the early part of the experiments on naming objects. This tendency has been noted before. Very often in naming some objects the patient would say, either immediately or after a short interval, 'brown paper' or 'green paper.'

On February 28 the patient was asked to name all the colors that had been used in the experiments with him. He said: 'brown, gray, brown, yellow, green, red, blue, purple, pink, black, white.' This would indicate that the names of the colors were not entirely associated with the appearance of the cards, and it is probable that there was more or less abstractive ability.

The experiments on number training were made in about the same manner as those on colors. The numbers were about one inch high, placed on cards four inches long and two inches broad. These cards were placed before the patient separately, but in an irregular order, until he had named them, and when mistakes were made there was a procedure similar to that used in the color-naming experiments. In Tables III. and IV. will be found, respectively, the percentages of correctly named numerals throughout the experiments and the misuse of the number names.

The retention of the practice effect for the three weeks' interval between February 23 and March 15 is noticeable as in the case of the color names (Table I.).

TABLE III.

Percentages of correctly named numbers.

Date.	Percentage Correct.	Number of Experiments.
Dec. 20-24	42.3	52
Dec. 26	42.9	14
Jan. 11-14	66.1	56
Jan. 16-21	71.1	152
Jan. 24-28	67.6	139
Jan. 31-Feb. 4	72.8	136
Feb. 6-10	83.9	118
Feb. 15-18	93.5	107
Feb. 21-23	92.5	65
March 15	92.6	108
March 17	92.6	54

TABLE IV.

Incorrect naming of numbers.

Numbers.	Number of Times Incorrectly Named.	Number of Times Names Used Incorrectly.
1	5	2
2	10	8
3	5	15
4	16	5
5	21	14
6	18	28
7	7	40
8	18	33
9	13	39
10	33	10
Miscellaneous.	—	16

At first there was considerable difficulty in naming '10,' the patient often getting the name only after saying '9-10' or '8-10.' A number of experiments were made to determine any number preference the patient may have had, in order to see whether the accuracy with which any number was named depended upon the facility of its

use. The patient was instructed to give at random single numbers, not in forward or backward sequence, until told to stop. Unfortunately he did not understand the condition regarding sequences, for there was a great tendency to give the combinations 3-4-5 and 7-6-5. The number 5 was, accordingly, the one most used. The variations in totals of the other digits were not sufficiently marked to indicate any special preference, and the ease of liberation, therefore, did not greatly differ.

When the figures in Tables I. and III. are compared with the results of experiments upon the acquirement of a new habit, the resemblance is striking. In forming new associations or habits at first the progress is slow, and the habit is perfected gradually. The curve of efficiency rises by little and little until it reaches its maximum point, *i. e.*, to one hundred per cent. of right cases in experiments similar to these. In the reacquirement of an old habit, the course runs somewhat differently. Consider the case of one who has not had an opportunity to swim or skate for some years. The first time after this period of rest he goes into the water or attempts to strike out on the ice the adjustment of the muscles and the movements necessary to properly perform the acts are not very accurate, but with very slight practice most of his former activity returns. In the case of this patient we find that this process, *i. e.*, sudden return to former efficiency after little practice, has not gone on, but that the gradual betterment is more like the acquirement of a new habit. This would indicate, it seems to me, that not all the old brain paths were being reopened, but that in all probability new connections were being made. In harmony with this view we have the fact of the 'vicarious' function of the cerebrum, that one part or one hemisphere may take up the lost functions of another part or side. It seems probable that this is what happens always in cases of aphasia, in which there is any amount of reeducation.

That new brain paths may be broken through is evident from the few experiments made to get the patient to acquire the German equivalents for the words 'pencil' and 'pen.' The patient, it is said, had no previous knowledge of German. The word for pencil (*Bleistift*) was shown to him, the pencil put before him, and he read the word. After each five readings the word was covered up, the pencil was removed and he was asked to give the German word for 'pencil.' In reading the word he made many mistakes at first, for example, *Bleistiff*, *Bleiskiff*, *Bleistaft*, and a combination of *Blein* or *Blant* with one or other misreadings of the second part of the word. In the recall of the word similar errors are noticed. In the same manner experiments were made with *Feder*; the word was shown and a

pen placed on the table in front of the patient. After five readings of the word it was covered up and he was asked to tell what it was. The results of these tests are as follows:

Day 1, A.M. Pencil: Experiments⁶ 1, 2, 3—*Bleinstift*; 4—*Blantstift*; 5, 6, 7—correct. Twenty seconds later he gave the word as *Bleiskiff*. Pen: Experiments 1, 2—correct. Thirty seconds later he confused this word with the one for pencil and said *Blanskiff*. Five hours later when asked what pencil and pen were, he had forgotten, although he had retained the word *Feder* for an hour. When the word *Bleistift* was shown to him he remembered that it was the equivalent for pencil.

Day 1, P.M. Pencil: Experiments 1, 2, 3, 4, 5, 6, 7—correct. Fifteen seconds later, *Bleisplift*; after forty seconds, *Bleiswift*; after forty minutes, *Beltfed*; and after an hour, *Befat*.

Day 2, A.M. When asked the equivalent of pencil, he said '*Fils*,' and pen, '*Fre, Fra, Frain*.' When the word *Feder* was shown to him he immediately said 'pen.' On this morning twenty-five readings of each word were made by him, and after each five there was a correct reproduction. Twenty minutes later he called a pencil '*Bleiswift*,' and twenty-five minutes after the final repetitions of *Feder*, he said 'pen is *Swe-id*.' Fifteen minutes later he recognized the word *Bleistift* and gave it its proper meaning.

Day 2, P.M. Before any experiments were made in the afternoon the patient was asked 'Pen'? and replied '*Be*'; 'Pencil'? and replied '*Methfas*.' When shown the word *Feder*, he again immediately said 'Pen.' At this sitting two experiments were made with pen, and three with pencil; all the results were correct. Twenty minutes later pen = *Feder* and pencil = *Bleiswift*, and the same answers were given an hour after the repetitions.

Unfortunately at this point the experiments were discontinued before the words had been perfectly learned. The results that were obtained indicate, however, the possibility of the formation of new association speech paths, and the rapidity of assimilation of the two words, show the feasibility and quickness of the reeducation process.

The Acquirement of More Complex Speech.—Many neurologists recommend the training in sounds of vowels and consonants, and the training in the different parts of speech before more complex material

⁶ Each experiment, it will be remembered, consisted of five readings and the immediate reproduction, as soon as the printed word and object could be taken away. The reproduction is the result noted in each experiment.

⁷ It should be remarked that many of these nonsense words can not be accurately represented here. It was extremely difficult to transliterate such unfamiliar sounds, but I have given what appeared to me to be the nearest approach to what the patient said.

is tried. To see how difficult or easy it would be to acquire long sentences and many ideas at once, an attempt was made to have the patient memorize the first stanza of the well-known poem, 'The Village Blacksmith.' The conduct of the experiments was as follows: a part of the stanza, one or more lines, typewritten, was put before the patient. This he read aloud five times, and on its withdrawal he attempted to repeat it. This went on, five readings and then a memory test, until he had several successive times correctly reproduced the part. Then another part was placed before him, with alternate five readings and memory test, etc. A tabular account of the results follows:

First day. Whole Stanza, 5 experiments (*i. e.*, 25 readings and memory tests); result of fifth experiment: "Under the sinews chestnut tree are brawn beside the tree—brawny man with sinewy hands—brawn hands and muscles of broadened hands."

Second day. Line 1, 6 experiments: 2, 5 and 6 correct; line 2, 6 experiments: 2, 5 and 6 correct; lines 1 and 2, 12 experiments: 9 correct.

Third day. Lines 1 + 2, 8 experiments; and alternately lines 1 + 2 and line 2, 9 experiments each: first line given well throughout the series of the combination test; second line given well alone, but not in combination except in experiments 22, 26 and 27. Line 3, 4 experiments: all correct. Line 4, 4 experiments: all correct. Lines 3 + 4 alternating with line 4, 5 experiments each: line 4 remembered poorly alone as well as in combination; experiment 11 (lines 3 + 4), memory correct.

Third day, P.M. Memory of the four lines before experiments were begun: "Under the chestnut tree—springing—no—under the springing chestening tree the village man—man is a mighty man was he." Lines 1 + 2, 6 experiments: 3, 4 and 6 correct reproduction; lines 3 + 4, 7 experiments: 5, 6 and 7 correct memory. Lines 1 — 4, 10 experiments: the best reproduction (ninth experiment) was as follows: "Under the spreading chestnut tree, the village smithy stands. The man, a mighty man is he, with powerful hands and—."

Fourth day, A.M. Lines 1 — 4, 5 experiments, and alternately lines 1 — 4 and lines 3 + 4, 10 experiments each: the best results for the four lines were after experiments 2 and 4. In these two tests there was a mistake in only the third line as follows: "A man—a mighty man is he."

Fourth day, P.M. Lines 1 — 4 and lines 3 + 4 alternately (8 experiments each and one extra 1 — 4): after the ninth experiment, result similar to the morning trials, the other tests were not so good. Each time lines 3 + 4 were used alone, however, the memory for these was perfect.

Fifth day, P.M. The memory for the four lines before any reading experiments were made was as follows:

- A. "Under the spreading swing tree
The villing wishy man.
A man—a mighty man is he
With long—and vigoury."
- B. "Under the side of the spreading tree
The wising—the village smithy smelt
The man, a mighty man is he
With—and many name."

Only two experiments were made on this day, lines 1 — 4, the result of the second being like that of the best on the previous day.

No further attempt was made to proceed to lines 5 and 6, as it seemed probable that in the combination of the last two lines with the four previous ones there would be an exaggeration of the difficulty in remembering. The results obtained, however, indicate that the learning process in this patient took on the same character as does the learning by normal subjects. The greatest difference is in the number of repetitions necessary to break through smooth brain paths. The results indicate, in addition, that reeducation is not such a difficult matter, and that a few days' training may be sufficient to change a patient from a condition of very feeble speech ability to one in which he could express his ideas well enough to have his wants attended to. Moreover, this would be accomplished more easily had we information regarding such a patient's habits, likes and dislikes, previous education, books read, etc.

That this last statement is true is borne out by the results of training the patient to rememorize the Lord's Prayer. I desired to work with something the man had formerly known well, in order to ascertain whether or not it took so long as the previous work. Before he read the prayer his memory reproduction was: "Our heavenly Father, in thy name—thy kingdom come." Three readings on the first day with memory test following each did not seem to greatly improve this rendering, but on the following day after three experiments (two readings each) the patient left out very little ('who art in heaven') and became confused in part ('give us each day our daily bread and to do with . . . do our doubts with our debtors without our duties'). The same afternoon two experiments were made, each after two readings, with the result of having the same part confused. On the following morning before reading the patient left out 'lead us not into temptation,' but did not greatly confuse the rest of the prayer. Twelve readings were then made and the memory tested after each two readings. The final result after these experi-

ments was a slight mistake, 'lead us under temptation.' About five hours later after four readings the whole prayer was reproduced accurately and without hesitation.

In number of words this prayer is three times as long and in number of ideas twice as complicated as the four lines of 'The Village Blacksmith,' but the subconscious remnants of the prayer, coupled perhaps with a greater interest, served to make the patient master of this composition after twenty-five readings.

The results of all the experiments indicate the relative ease of reeducation in conditions of aphasia, and it appears advisable to attempt such reeducation whenever the physical condition of the patient permits. There is danger of too great mental as well as physical work in some aphasic cases and a too rigid course of training should not be attempted. Aphasias due to emboli could, of course, be more actively treated than the cases due to cerebral hemorrhage. In all cases in which there is a possibility of training, a few minutes each day, morning and afternoon, would soon produce noticeable betterment. The experiments which have been carried on with this patient seem to indicate that new brain paths are opened in the reeducation process, and in this work it is probable that the right side of the cerebrum takes part. More experiments are needed (and on more cases) along the lines of the formation of definite speech associations before the latter conclusion can be conclusively drawn.

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DISCUSSION

IMMEDIATE EMPIRICISM

PROFESSOR BAKEWELL writes as follows, in an open letter to me in this JOURNAL concerning 'Immediate Empiricism':¹ "My difficulty, in short, is simply this: Either everything experienced is real exactly as, and no further than, it is then and there experienced—and then there is no occasion to speak of correcting or rectifying experience; or, there is in every experience a self-transcendence which points beyond that thing *as experienced* for its own reality—and then good-bye to immediatism." And in a foot-note he says that my view is atomistic, chopping reals off from one another, and that if 'this consequence is avoided by making the earlier experience con-

¹ Vol. II., No. 19, p. 521. See also this JOURNAL, Vol. II., No. 15, p. 393.